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ABSTRACT

In order to determine the effectiveness of improved information dissemination and assessment techniques in reducing highway accidents, a set of seven targeted driver license manuals and tests were developed for the following groups of drivers: new drivers, youthful drivers, renewal applicants, older drivers, traffic violators, accident repeaters, and drinking drivers. The contents of the manuals and tests were based upon an analysis of critical information requirements for each target group and an assessment of existing information deficiencies of drivers relative to these requirements. The manuals and tests were administered to a sample of 30,000 drivers to determine their effectiveness in leading to acquisition, retention, and application of safe driving information. The amount of information acquired showed knowledge gains ranging between 20% and 30% for all target groups except the traffic violator group, which showed an 11% gain. A retention test administered to the new driver and renewal groups after a five-month interval showed a one-half to one-third information loss. The older driver group showed a slight gain. In addition to the manuals, a one-hour audiovisual presentation of the manual's contents was developed and yielded an information gain of 15% and 20% respectively among reading-disabled and mentally retarded high school students. (This report is a 48-page summary of the material in the 200-page final report, volume II, which is available separately--CE 015 838.) (Author/EM)

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SAFE DRIVING KNOWLEDGE DISSEMINATION AND TESTING TECHNIQUES
Volume I: General Findings

Contract No. DOT-HS-4-00817

May 1977

Final Report

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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16. Abstract

In order to determine the effectiveness of improved information dissemination and assessment techniques in reducing highway accidents, a set of seven targeted driver license manuals and tests were developed for the following groups of drivers: New Drivers, Youthful Drivers, Renewal Applicants, Older Drivers, Traffic Violators, Accident Repeaters, and Drinking Drivers. The contents of the manuals and tests were based upon an anlaysis of critical information requirements for each target group and an assessment of existing information deficiencies of drivers relative to these requirements. The manuals and tests were administered to a sample of 30,000 drivers, primarily from the State of Virginia, in order to determine their effectiveness in leading to acquisition, retention, and application of safe driving information. The assessment of information acquisition evidenced knowledge gains ranging between 20% and 33% for all target groups except the Traffic Violator group which showed only an 11% gain. A retention test administered to the New Driver and Renewal group after a five-month interval showed a 1/2 to 1/3 information loss. The Older Driver group showed a slight gain. The accident and violation records of drivers in all groups will be compared with those of a randomly selected control group of equal size over 12, 18 and 24 month intervals. In addition to the manuals, a one-hour audiovisual presentation covering the contents of the New Driver manual was developed and yielded information gain of 15% and 27%, respectively, among reading disabled and mentally retarded high school students.

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METRIC CONVERSION FACTORS

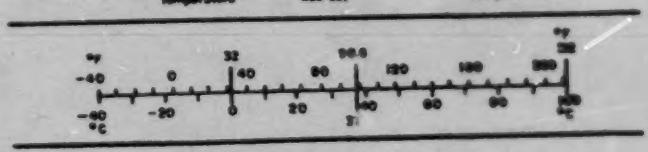
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



EXECUTIVE SUMMARY

SAFE DRIVING KNOWLEDGE DISSEMINATION AND TESTING TECHNIQUES: FINAL REPORT

Contract No. DOT-HS-4-00817

National Public Services Research Institute (NSPRI)
421 King Street
Alexandria, Virginia 20590

Report Date: June 1976

Abstract

In order to determine the effectiveness of improved information dissemination and assessment techniques in reducing highway accidents, a set of seven targeted driver license manuals and tests were developed for the following groups of drivers: New Drivers, Youthful Drivers, Renewal Applicants, Older Drivers, Traffic Violators, Accident Repeaters, and Drinking Drivers. The contents of the manuals and tests were based upon an analysis of critical information requirements for each target group and an assessment of existing information deficiencies of drivers relative to these requirements. The manuals and tests were administered to a sample of 30,000 drivers, primarily from the State of Virginia, in order to determine their effectiveness in leading to acquisition, retention, and application of safe driving information. The amount of information acquired showed knowledge gains ranging between 20% and 33% for all target groups except the Traffic Violator group which showed only an 11% gain. A retention test administered to the New Driver and Renewal group after a five-month interval showed a 1/2 to 1/3 information loss. The Older Driver group showed a slight gain. The accident and violation records of drivers in all groups will be compared with those of a randomly selected control group of equal size over 12, 18 and 24-month intervals. In addition to the manuals, a one-hour audiovisual presentation covering the contents of the New Driver manual was developed and yielded information gain of 15% and 27%, respectively, among reading-disabled and mentally retarded high school students.

Executive Summary

Purpose and means of accomplishment

The purpose of this effort was to determine the effectiveness of improved information dissemination and assessment techniques in reducing highway accidents. The means of accomplishment was through:

- Identifying the needs of various categories of drivers.
- Meeting those needs through the identification of information to be disseminated to the various driver categories.
- Developing and testing driver information manuals for the target categories.
- Developing and testing audiovisual material for reading disabled and mentally retarded drivers.
- Developing guidelines that others should follow in the development of State driver information manuals for target populations.

Background

A major component of a productive driver improvement program is to disseminate safe driving information to the segments of the population to be effected. The rationale behind this is that although safe driving information cannot be expected to guarantee safe driving behavior in and of itself, it still is a prerequisite to that behavior. Also, the information system to be used must be flexible enough to address not only new drivers or out-of-state transfers, but to address various target groups in the driving population or the entire driving population.

State driver manuals currently in use are largely confined to a presentation of the State's traffic laws or "rules of the road." They would be more informative, and more effective, if extraneous or rarely used information was deleted from them and they were aimed at meeting the specific needs of drivers.

The driving public seems to hold the belief that driver knowledge tests are used to separate the good drivers from the bad drivers. Nothing could be further from the truth. There simply are no tests to our knowledge that will accomplish this most desirable goal. However, tests might be used to serve three basic functions:

1. Assessment: to determine whether an applicant sufficiently meets the knowledge criteria to be granted a license.

2. Diagnosis: to identify specific knowledge deficiencies to be overcome before a license may be granted.

3. Incentive: to motivate the applicant to acquire the necessary information.

The present use of driver tests for assessment and diagnosis is questionable, but their use as an incentive to information acquisition has been receiving increasing attention. It is believed that the primary value of present driver knowledge tests is in their contribution toward forcing drivers to acquire information; that is, to read the manuals or other information sources. For those persons who are reading disabled, other means must be found for providing essential information to them.

Target groups

The target groups identified under this study were: new drivers; experienced drivers; older drivers; youthful drivers; violators; drinking drivers; medically impaired drivers; handicapped drivers; and reading/learning problem drivers. Once target groups were determined, the specific information requirements of each group were identified. A review of knowledge tests conducted in previous studies in Michigan and California failed to identify substantial differences in the information needs of most groups. Only the older drivers were judged to have information requirements that were different from those of the driving population at large.

It was concluded that new and youthful drivers should be combined into one group, because of the commonality of their information requirements. The driver information manual for this combined group was designed to address: licensing procedures; observation; communication; speed control; intervehicle separation; gap judgment; handling emergencies; physical and psychological factors; and vehicle maintenance.

Since some of the information necessary to new and youthful drivers would seem elementary and redundant to experienced drivers, it was determined that the information manual for this group could delete entirely or deal lightly with such information. Some topics in this category are: traffic control signs and signals; right-of-way laws; turn signals; and estimating gaps.

Older drivers, that is, drivers 60 years of age and older, were the only group that was determined to have special information needs. The areas of interest worthy of special treatment included: slow driving; looking to the rear; confusion; seeing and hearing; fatigue; health problems; medicines; traffic signs and signals, and alternatives to driving. The most suitable means of disseminating the information to these older drivers was determined to be through their peers, through a problem-oriented rather than person oriented approach, and through a media delivery system suitable for older persons, recognizing the need for large type, etc.

Information dissemination for traffic violators should concentrate on: exceeding the speed limit; driving too fast for conditions; following too closely; unsafe passing; failure to come to a complete stop at stop signs; running a yellow light; and knowing failure to yield the right-of-way. An approach that makes use of threats or moralizing appears to have little promise.

Information that should be transmitted to accident repeaters should include: scanning ahead, to the side, and behind; communicating the vehicle's presence through use of the lights, horn, etc.; maintaining a safety margin; and use of safety belts. This group should be diplomatically led to the conclusion that all parties of an accident generally share some responsibility for it.

Drinking drivers are worthy of special attention for two reasons. One reason is that they figure so high in serious traffic crashes, and the other is that the behavior that leads to the offense does not involve how one drives, but rather when and how much one drinks. These drivers are usually quite knowledgeable about the traffic laws, and information programs designed for them should include: the magnitude of the drinking-driving problem; effects of alcohol; alcohol content of drinks; separating drinking and driving; controlling drinking, laws and penalties; and the need for a plan by the drinking driver.

Manuals and tests were developed for each of the foregoing target groups. All manuals were pilot tested, revised on the basis of the test results, and then given one final review by consultants and representatives of each pilot group in order to verify their adequacy.

Test development

A set of multiple-choice test items was prepared to accompany each of the manuals. The number of items varied with the size of the manuals, ranging from 10 items for the drinking driver's manual to 140 items in the case of the manuals for new drivers and renewal applicants. All tests were carefully reviewed for comprehensiveness, level of difficulty, and internal consistency.

Other considerations in test construction included alternative responses, wording, and test structure. They were pilot tested and identifiable deficiencies were corrected.

Alternative information presentation and testing systems

Although a printed manual and test are probably the most cost effective means of reaching the general public, there are segments of the population that cannot be addressed in that fashion. These include: illiterates; marginal readers; and foreign-speaking illiterates. A set of test questions was presented to a group of drivers by means of the following informational modes: written; graphic; static audiovisual; and dynamic audiovisual. The results of this test appear to indicate the superiority of the dynamic mode.

An effort was made to determine the relative cost-effectiveness of the following means of achieving the dynamic mode: filmstrip/tape; slide/tape; continuous film; interrupted film, and videotape. The filmstrips and slides were classed as "dynamic" for this purpose since they can be projected in a series to simulate motion. These media were evaluated against the following criteria: image; motion; reliability and durability (hardware and software); ease of operation; maintenance; ease of updating; and cost.

On the basis of this comparison, filmstrips and slides were eliminated due to the failure of their cost advantages to offset their inability to handle motion adequately. Videotape was also eliminated due to the high cost of hardware, low durability of software, and the complexities of operation and maintenance.

Of the remaining media, an interrupted 8 mm presentation appeared to have the greatest long-range potential. However, since the required equipment is not in general use, an interrupted presentation would have a limited market at the present time. For this reason, it seemed best to proceed with development of the standard 16 mm motion picture within the present project. Preparing the presentation in a 16 mm format would allow prints to be prepared in either 16 mm or 8 mm.

Based upon these conclusions, a set of eight film presentations was prepared and tested. Project funds did not permit the preparation of a dynamic audio-visual test to accompany the informational presentation. However, the audiovisual test that was developed for the experimental study of informational modes provided some insight into the requirements of an audiovisual test. These requirements included: automation; simple instructions; increasing difficulty; problem identification; presentation of alternatives; response recording; and test pacing.

Evaluation

An evaluation of the manuals, tests, and audiovisual information presentation was undertaken in the State of Virginia. Evaluation of the manuals and tests involved some 60,000 drivers representing all of the target groups. Within each target group, drivers were randomly divided into experimental and control groups. Drivers in the experimental groups were administered the project developed manuals and test while those in the control groups were subject only to procedures currently employed by the State. The effectiveness of the manuals and tests were evaluated against three objectives: information acquisition; information retention; and information application. The information acquisition and retention test results for all target groups are presented on the last page of this document.

Data collection on these drivers is still underway. At 12, 18 and 24 months following completion of test administration, the records of all drivers in the State of Virginia will be searched and those of drivers in the study will be read into separate files, classified by target group designation and study group assignment (i.e., experimental versus control). The accidents

and violations appearing in the records of drivers in each target group and each treatment group will be tabulated and the following totals obtained:

- o Number of accidents reported
- o Number of convictions for traffic violations
- o Convictions for violations involving an accident
- o Administrative actions

  Advisory letters

  Group interviews

  Personal interviews

  Clinics

  Probation

  Suspensions

Conclusions and recommendations

A list of conclusions was prepared as a result of the activities and findings experienced during this study. Recommendations were presented, addressing both research and development and operational programs.

The conclusions were as follows:

1. A manual providing a comprehensive and exhaustive presentation of critical safe driving information can be prepared for new drivers within the resources available to most driver licensing agencies.

2. Experienced drivers currently present the same general pattern of information deficiencies as do new drivers.

3. Traffic violators, including drinking drivers, are no different from the general driving public with respect to their information deficiencies or needs.

4. Like traffic violators, drivers who have been in accidents present the same general pattern of information strengths and weaknesses as is presented by the general driving public.

5. Older drivers are the only group presenting unique information requirements.

6. Drivers in all groups are capable of realizing significant knowledge gains from manuals designed to meet their information needs.

7. A significant information loss occurs following acquisition of large amounts of safe driving information, such as is provided to new drivers.

8. An audiovisual presentation is capable of leading to significant information gains among reading disabled and learning disabled license applicants.

9. No conclusions as to the effectiveness of the various manuals and tests in preventing accidents can be offered at the present time. These conclusions will be presented in a separate report, at a later date.

ACQUISITION AND RETENTION TEST RESULTS FOR ALL TARGET GROUPS

GROUP	PRETEST		ACQUISITION				RETENTION			
	MEAN	N	MEAN	N	GAIN	SIGNIF-ICANCE	MEAN	N	RESIDUAL GAIN	SIGNIF-ICANCE
New Driver	61.4	100	81.7	100	33.1%	P < .01	72.8	99	18.6%	P < .01
Renewal	62.9	100	79.8	100	26.7%	P < .01	74.8	63	18.9%	P < .01
Older Driver	69.0	100	83.0	100	20.3%	P < .01	88.8	74	28.7	P < .01
Violator	61.8	100	68.6	200	11.0%	P < .05				
Accident Repeater	64.1	100	83.0	100	29.5	P < .01				
Drinking Driver	64.9	100	86.2	100	32.0%	P < .01				
Reading Disabled Unlicensed	58.3	40	67.3	40	15.4%	P < .01				
Licensed	67.0	35	72.7	35	8.5%	P < .05				
Mentally Retarded	49.7	15	63.3	15	27.4%	P < .05				

PREFACE

This report describes the preparation and evaluation of an information program consisting of driver license manuals, tests, and an audiovisual presentation system. The program was designed to meet the needs of various categories of drivers. The work was performed by the National Public Services Research Institute (NPSRI) under contract to the National Highway Traffic Safety Administration (Contract No. DOT-HS-4-00817). At the time the study began, NPSRI was a division of the School of Public Services, Central Missouri State University. Upon becoming an independent organization in April 1975, NPSRI completed the work under subcontract to Central Missouri State University.

The NPSRI effort was directed by Dr. A. James McKnight, Principal Investigator. Dr. McKnight was assisted by Mrs. Molly A. Green, who served as Project Administrator. Mr. Gerard Y. Issembert was responsible for development of the audiovisual presentation and test program. Dr. Richard Kaywood, University of California at Long Beach, played a major role in preparation of the manuals.

Other NPSRI staff members and consultants assisting in various phases of the project include the following: Dr. Anthony Pfannkuche, Mr. Stephen Steurer, Dr. Kenard McPherson, Mrs. Elise Brown, Miss Karin Kephart, Miss Valerie Pote, Miss Velva Morgan, Mr. Randy Scott, Mr. Lee Harper, Mr. William J. Coltellero, Mr. William Seals, Mrs. Wanda Dorpfeld, and Mr. Michael Chatron.

A major share of the work involved in evaluating the program was performed by representatives of the Driver Services Administration of the Virginia Division of Motor Vehicles. Those contributing heavily to the project were Mr. Richard Spring, Mr. James Parr, Mr. Joseph Augeri, and Mr. Richard Edwards.

The staff of the Central Missouri State University provided encouragement and assistance throughout the project. The authors are particularly indebted to Dr. Robert L. Marshall, Dr. Robert Baldwin, and Dr. Jack J. Carmichael.

Finally, the staff wishes to acknowledge the guidance and help provided by the NHTSA Contract Technical Manager, Dr. John Eberhard, and those who assisted him, most notably Dr. Harold Boohrer and Mr. John Matthews.

A more detailed description of the project, including its methods and results may be found in the following report:

- Safe Driving Knowledge Dissemination and Testing Techniques: Final Report.

Two additional reports prepared as a part of the project are the following:

- Safe Driving Knowledge Dissemination and Testing Techniques: Manuals

- Handbook For Developing Safe Driving Knowledge Dissemination and Testing Techniques.

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BACKGROUND

In recent years there has been an increasing interest in State Departments of Motor Vehicles in moving from a passive program of driver regulation to a more active program of driver improvement. Already, some States, such as California, New Jersey, and Virginia, have considered legislation that would enable the Department of Motor Vehicles to play a larger role in assisting drivers within the State to operate their vehicles more safely and efficiently. These States have begun to make a major commitment to establishing a large-scale driver improvement program.

The major component of a driver improvement program should be a comprehensive safe driving information system. The system would have two, interrelated objectives.

1. To disseminate safe driving information to the general driving population in the State; and

2. To assess the level of safe driving knowledge among individuals holding or applying for licenses.

In order to accomplish these objectives, the information system should include these elements:

1. A Set of Safe Driving Manuals: Printed materials capable of communicating information critical to safe driving in a highly effective and concise way.

2. A Set of Tests: Printed examinations that interface with the manuals and measure, by sampling from the whole range of critical safe driving information, the applicant's level of knowledge.

3. Alternative Information Dissemination System: Methods other than printed media for communicating safe driving information to drivers throughout the State, especially to that substantial portion of the population which has reading/learning difficulties.

A comprehensive safe driving information system differs from the more traditional DMV licensing program in several important ways. First, it is addressed to the whole driving population, not just to new drivers, out-of-State transfers, or the small percentage of drivers who commit major, persistent traffic violations. Second, it recognizes that the knowledge requirements of all drivers are not identical. Finally, and most significantly, it is intended to present the driving knowledge

which is critical to the safe and efficient use of the motor vehicle. It is not limited to legal requirements, regulations, and "rules of the road," as most DMV manuals have been in the past. The design of the information system must take into account these three essential characteristics.

MANUALS

The typical State Drivers Manual in current use is largely confined in content to "rules of the road," interpretation of signs and signals, basic administrative and licensing information, and a few of the more salient driving practices. A survey of State Manual content by Nuckols (1972) revealed that most manuals contain little task relevant information.

Any effort to develop truly comprehensive manuals, however, must cope with the problem of sheer information volume. A publication that attempted to encompass all of the information that could conceivably be relevant to driving safety would be bigger than the largest existing driver education textbook. Such a publication would be inappropriate to the needs of a State DMV.

The volume of information can be reduced by preparing manuals that are aimed at meeting the critical information needs of individual groups of drivers. Drivers differ in their information needs as a function of differences in age, background, attitudes toward the highway traffic system, driving experience, and other characteristics. Where differential needs can be identified, manuals can be effectively and economically directed toward these needs.

TESTS

The responsibility for determining whether a driver is sufficiently knowledgeable to meet the demands of safe driving falls principally upon State driver licensing agencies. In order to obtain a license, an applicant must demonstrate a certain, predetermined level of knowledge. Typically, this is expressed as a percentage score on a written examination and an on-the-road driving test. All States administer a written and/or oral test of knowledge to new drivers and drivers transferring residence to the State. Some also administer knowledge tests to renewal applicants. These tests serve three basic functions:

> Assessment: to determine whether an applicant sufficiently meets the knowledge criteria to be granted a license.

Diagnosis: to identify specific knowledge deficiencies to be overcome before a license may be granted.

Incentive: to motivate the applicant to acquire the necessary information.

The value of tests for the purposes of assessment and diagnosis is questionable. There is little good empirical evidence to demonstrate a relationship between test results and driving performance because all drivers must ultimately pass a test before they may legally drive and compile an official driving record.

A test intended for diagnosis would have to be extremely lengthy. Since a driver's information deficiencies tend to be quite specific to individual information items, a test would almost have to provide a complete census of the required knowledge--virtually reproduce the manual itself--to have much diagnostic value.

The role of the licensing tests as an incentive to information acquisition has received increasing emphasis in recent years. In this role, the licensing test joins the licensing manual to form a package. The manual helps drivers prepare for the test; the test helps assure that drivers prepare by reading the manual. Throughout the study described in this report, priority was given to the role of tests as an incentive. The view was taken that the primary way in which a knowledge test contributes to driving safety is by forcing drivers to acquire information--that is, to read manuals or consult other information sources.

In order to serve as a proper incentive, tests must be constructed so as to constitute a comprehensive and representative sample of critical information contained in the manual. The following criteria must be met:

1. Well-constructed Items: items should be written and presented so that a knowledgeable applicant will answer correctly, and the unknowledgeable will not.

2. Comprehensive Sampling: items should sample from the full range of critical information in the manual.

3. Representative Sampling: the applicant should not be given advance clues as to which specific information items will be included in the test as such will render the test sample unrepresentative of the applicant's knowledge.

The tests are developed to provide a sufficiently representative sampling of critical information to motivate applicants to learn the information contained in the manual.

ALTERNATIVE INFORMATION DISSEMINATION SYSTEMS

While the conventional printed driving manual is a generally cost-effective way of presenting a large amount of information to a large number of drivers, there is a significant portion of the driving population for which printed media are not effective. It is estimated that as much as 10 to 15 percent of the adult population have reading difficulties that are sufficiently serious to preclude comprehension of conventional DMV materials. Even after an effort is made to lower the reading level of printed manuals, there remains an important segment of the driving population unable to absorb safe driving information in printed form.

Alternative systems of delivering safe driving information are necessary adjuncts to an effective program of information dissemination to the entire general driving population. An effective alternative system should be able to communicate information to individuals who are unable to use printed manuals with the same level of achievement as characterizes use of manuals.

PROJECT OBJECTIVES

The project develops a system of safe driving information dissemination and assessment that assures that drivers acquire, retain, and effectively apply the information needed to drive safely. It achieves this goal through the fulfillment of these objectives:

1. The development of manuals capable of communicating critical safe driving information.

2. The development of tests that are capable of providing a reliable assessment of an applicant's possession of critical safe driving information.

3. The evaluation of the ability of manuals and tests to lead to the acquisition, retention, and effective application of safe driving information.

4. The additional development of alternative systems of delivering critical safe driving information to reach those potential drivers unable to use conventional print media fully and effectively.

CONTENTS OF REPORT

This final report describes the development and evaluation of a set of manuals, tests, and an alternative system for delivering information to drivers. Discussion of the development process is divided as follows:

Identification of Target Group

Determination of Information Requirements

Specification of Information Requirements

Development of Manuals

Development of Tests

Alternative Information Presentation and Testing Systems

Evaluation

IDENTIFICATION OF TARGET GROUPS

The identification of target groups involved the search for readily identifiable groups of drivers having different information requirements. Information requirements, in this case, means both the nature of information needed and the manner in which it must be presented. The phrase "readily identifiable" means that variables used for target grouping must relate to characteristics of drivers that State departments of motor vehicles would have access to, such as age, driving experience, or driving records.

In order to identify groups with different information needs, a panel was assembled under the auspices of the California Traffic Safety Education Task Force. This panel consisted of individuals from the education, licensing and research branches of highway safety. Each of the panelists had specific experience that would provide them access to the information needs of different drivers. The panel met for three days during which the information needs of the various prospective target groups were discussed.

The results of the panel's deliberations are detailed by Goldstein (1974). The target groups identified as candidates for a targeted information program were as follows:

New drivers--drivers who have not been previously licensed to drive or who have had a license for less than three years.

Experienced drivers--drivers who have been licensed to drive for three years or more.

Older drivers--experienced drivers over the age of 60.

Youthful drivers--drivers under the age of 21, who are either new drivers or experienced drivers.

Violators--drivers convicted of two or more traffic violations within a relatively short period of time, (e.g., one-three years).

Drinking drivers--drivers convicted of a drinking-while-driving offense.

Medically impaired drivers--drivers suffering from a health disorder that results in loss of consciousness or loss of ability to control the car.

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Handicapped drivers--drivers suffering from a physical handicap that could, in the absence of some compensating mechanism, degrade the driver's ability to operate safely.

Reading/learning problem drivers--drivers who lack the ability to comprehend the existing State licensing manuals, including slow learners, illiterates, and foreign speaking literates.

DETERMINATION OF INFORMATION REQUIREMENTS

Once target groups had been determined, the specific information requirements of each group were identified. An exhaustive survey of the highway safety literature relating to any studies in which unique information needs had been identified for any of the target groups. Since the driving tasks that confront each target group are largely the same, one would expect similarity among the information requirements. However, there were two respects in which it seemed information requirements for different groups might be delineated. First, it was thought that the same information might have different levels of criticality for various groups. For example, information concerning the importance of frequent vision and hearing checks, while important to all drivers, would seem to be most critical to older drivers. Secondly, it was thought that groups might differ from one another relative to specific items of information in which they are deficient and hence needed to have supplied to them. The extent to which a given target group would require a particular item of information would be a joint function of its criticality to the drivers in the target group and the extent to which those drivers were deficient in possession of the information.

The determination of information criticality for the various target groups was performed by a panel of "Target Group Specialists," each of whom had experience in dealing with drivers a a particular target group. The Target Group Specialists were provided a lengthy list of information items covering all aspects of driving. They were asked to indicate those having unusual criticality to drivers in their particular target group. The basis of the list was a comprehensive and detailed analysis of driving tasks performed under an earlier NHTSA contract.

The identification of information deficiencies involved an analysis of knowledge tests administered to drivers in the States of Michigan and California. Responses to individual test items were classified by target group and the results for each target group compared with those of the driving population at large. Those items in which target group drivers did significantly poorer than other drivers were identified.

The results obtained from the identification of information criticality and information deficiencies failed to identify substantial differences in the information needs of various target groups. Only the older drivers were judged to have information requirements that were different from those of the driving population at large. While the analysis of test scores did disclose some differences among target groups, the differences were more readily attributed to characteristics

of tests than to information criticalities or deficiencies. However, it did provide a volume of information that was extremely useful in identifying approaches to be taken in disseminating information and in administering tests to the various drivers. From the results of the literature survey and the two analyses perfromed, a set of information requirements were established for each target group. These requirements are summarized in the following paragraphs.

NEW AND YOUTHFUL DRIVERS

The New and Youthful Driver target groups were combined into a single group owing to the communality of their information requirements. Part of this communality is a result of the fact that the overwhelming majority of new drivers are youthful drivers. However, even where new drivers differ in age, they have essentially the same information requirements.

Content

Informational requirements related to safe vehicle operation have been organized in terms of these driving principles. An example of the economy to be secured from this organization may be seen in information relating to turn signals. The simple principle "signal every direction change" makes it unnecessary to cover specifically the signalling of lane changes, turns, entering and leaving freeways, pulling away from the curb, and preparing to park.

Licensing Procedures--Since the applicant's purpose in reading a manual is to obtain guidance in getting a license, it is reasonable to open the manual with an explanation as to how this is done. The explanation should include at least the following:

- Licensing Requirements
- License Application Procedures
- Locations
- Documentation Required
- Nature of Licensing Exam

Except for a few of the newer rules, such as those involving symbolic traffic control signs, new drivers appear to be highly knowledgeable with respect to rules of the road. However, since at least some of them obtained their knowledge from a driver's manual, it is necessary to provide rules of the road information.

Specific information requirements include the following:

- Traffic lights
- Traffic signs

  Stop
  Yield
  Do not enter
  Symbolic (e.g., no left turn, no U-turn)

- Right-of-way rules
- Lane control

  Thru lanes
  Passing lanes
  Turning lanes
  Lane control lights (reversible lanes)

- Parking regulations

  Separation from travel lanes
  Immobilizing car
  Securing car
  Leaving car

Observation--New drivers tend to focus their attention on the roadway directly in front of the car. They need specific information on where to look. Such information includes the following:

- Looking far enough down the road
- Scanning both sides of the road
- Looking to the sides at intersections
- Looking behind periodically when changing lanes, slowing down, or backing up

Communication--Test results indicate that new drivers are familiar with standard requirements for hand signals and use of turn signals. However, they tend to be less familiar with certain information related to the importance of signalling and information concerned with positioning the automobile so that its presence is communicated to other drivers.

Information requirements include the following:

- Communicating presence
- Daytime use of headlight
- Staying out of the blind spot
- Emergency signals for disabled vehicles
- Changing direction
- Slowing or stopping suddenly

Speed Control--Research shows that new drivers are overrepresented in high speed, out of control accidents. New drivers are generally relatively well informed concerning legal speed limits. However, they tend to be deficient in knowledge concerning the effect of conditions upon maximum safe operating speed.

Specific information requirements include speed limitations imposed by the following:

- Curves
- Lack of traction
- Hydroplaning
- Limited sight distance
- Traffic conditions

Intervehicle Separation--The literature suggests that inexperienced drivers tend to place too much trust in other drivers to perform correctly and, as a result, tend not to maintain the intervehicle separations needed to respond to errors on the part of other drivers. Specific information requirements include the following:

- Keeping an adequate following distance
- Keeping distance to the side

  Avoiding adjacent vehicles
  Separation from oncoming vehicles
  Changing lanes at freeway entrances
  Separation from parked vehicles

- Separating and compromising between lateral hazards
- Dealing with tailgaters
- Keeping a distance from hazardous drivers
- School buses and emergency vehicles

Gap Judgment--New drivers are notably deficient in their ability to judge intervehicle gaps when merging, crossing or entering traffic, or passing other cars. Since this ability is more dependent upon perceptual skill than it is upon knowledge, it can only be treated obliquely through information. This can be done by relating required gaps to known distances such as fractions of city blocks.

Information requirements include content concerning intervehicle gaps and procedures for the following:

- Merging with traffic
- Crossing and entering traffic
- Passing other cars

Handling Emergencies--Most new drivers lack the basic skill necessary to apply emergency procedures. However, if new drivers do not obtain the necessary information at the time of licensing, they may not have it when they are skilled enough to use it.

Content should include the following:

- Proper steering and braking on slippery surfaces
- Skid recovery
- Vehicle related emergencies, including brake failure, blowouts, power steering failures, and a stuck accelerator
- Emergency braking and steering
- Importance of seat belts

  Collision restraint
  Improved control
  Reduced fatigue

- Post-accident procedures

Physical and Psychological Factors--Because of their relative lack of skill, new drivers are particularly vulnerable to any physical or mental condition that degrades their ability to drive. Among the various conditions of concern, intoxication is probably the most critical to new drivers as a whole.

Content in this area should include the following:

- Magnitude of drinking-driving problem
- Effects of alcohol
- Controlling alcohol consumption

  Controlling intake
  Effect of food
  Knowledge of drink composition

- Elimination of alcohol
- Alternative transportation
- Laws, including implied consent

  Penalties

- Drugs and alcohol

Vehicle Maintenance--Information concerning vehicle maintenance is particularly important to new drivers owing to the tendency of teenagers to operate old vehicles and vehicles in disrepair. Information requirements should include the importance of inspecting and repairing the following:

- Headlights
- Brakes
- Turn signals
- Windows, windshields, and wipers
- Tires
- Steering
- Suspension
- Exhaust

The nature of State inspection requirements should also be covered.

Approach

The dissemination of information to new drivers should be approached in the following ways:

Factual Content--Information for new drivers should be highly factual. It should concentrate upon providing information that people do not know, in contrast with simply giving emphasis to things already known.

Explanatory Content--The manuals should provide the "why" as well as the "what" of driving safely. Valid and relevant explanatory information represents a potentially effective way of motivating drivers to employ safe-driving practices.

Situational Content--New drivers tend to have difficulty handling general driving principles and concepts owing to their lack of experience with the actual traffic situations to which they relate. Therefore, information should be made as situational as possible. Principles should be tied to their specific application by providing illustrative examples.

EXPERIENCED DRIVERS

Content

Licensed drivers, on the whole, exhibit the same pattern of information strengths and deficiencies as do new drivers. However, whereas new drivers may be presumed to have obtained much of their information from a manual, experienced drivers probably obtained most of their information from experience. This means the information that the great majority of experienced drivers already know can be deleted from their information requirements. Such information includes the following topics:

- Traffic control signals and signs
- Right-of-way laws
- Turn signals
- Estimating gaps

There are, in addition to these general topics, items of information in other content areas that are too specific to be characterized in general terms. These items may be found in the test statistics furnished with the project Final Report.

The lack of a significant difference between the information deficiencies of new drivers and those of experienced drivers merely reflects a present state of affairs, not an immutable fact of life. If a truly comprehensive manual and a test program were administered to all drivers within a State--licensed drivers, previoulsy unlicensed drivers, and out-of-State transfers--the general level of information among experienced drivers would be raised. Then, the information deficiencies of experienced drivers would be limited to (1) things that have been forgotten since the renewal examination was administered, and (2) changes in traffic laws and driving conditions that have occurred in the interim.

Approach

While the information requirements of experienced drivers and new drivers do not differ substantially, experienced drivers seem less willing to admit their need for driving information. This means that an information system intended for experienced drivers must justify itself to the examinee to a far greater extent than one intended for new drivers. Probably the most effective way to provide such justification is through a preliminary self-test that will reveal to experienced drivers the nature and extent of their knowledge deficiencies.

OLDER DRIVERS

Older drivers, that is licensed drivers 60 years and older, make up the one target group having clearly differentiated critical information needs and information deficiencies.

Content

The information requirements of older drivers include the following topics:

Slow Driving--Because of slowed reactions and difficulties in information processing, many older drivers tend to operate at a speed that is too slow for conditions. Treatment of this problem should cover the following topics:

- Maintaining the pace of traffic
- Using slow traffic lanes
- Avoiding the use of high speed highways
- Entering freeways at the speed of traffic
- Maintaining speed prior to leaving freeways
- Avoiding excessive slowing or stopping for turns

Looking to the Rear--Many older drivers experience difficulty in turning their heads and upper bodies due to muscular difficulties, arthritis, etc. As a result, they often fail to look behind them before changing lanes or backing. Information requirements include the following topics:

- Over-the-shoulder checks
- The use of special mirrors
- Proper backing procedures
- Parking so as not to have to back up

Confusion--Difficulties in information processing lead to confusion when operating in unfamiliar areas or difficult traffic conditions. Information requirements include:

- Avoiding unfamiliar areas particularly in rush hours
- Use of a passenger as navigator
- Avoiding hazardous backing or stopping

Seeing and Hearing--Deficiencies in seeing and hearing are prevalent among older drivers. Because the changes are gradual, they are frequently unnoticed. Information requirements include:

- Need for frequent vision checks, including night and peripheral vision
- Night driving procedures
- Compensating for hearing loss

Fatigue--Older drivers tend to get fatigued more easily than drivers of earlier years. This is compounded by a reluctance of older drivers to admit that "they aren't quite as young as they used to be." Information requirements include:

- Advanced preparation, including sleeping and proper eating
- Trip planning, including distance, route, and time
- Frequent rest breaks
- Sharing the burden of driving

Health Problems--The variety of various health problems become more frequent among older drivers. Among those critical to driving are high blood pressure, arthritis, and heart trouble. Information requirements include:

- The need for a physical checkup at least once a year
- The importance of avoiding strenuous driving when health is not good
- Dizzy spells and blackouts
- Need for medical control in the case of serious problems

Medicines--The increased use of medicine among older drivers results in an increase in the incidence of problems resulting from their improper use. Information requirements include:

- Importance and means of determing side effects of alcohol
- Avoiding taking alcohol in combination with medicines
- Limiting the use of alcohol

Traffic Signs and Signals--Many older drivers are unfamiliar with newer symbolic signs and signals. Information requirements include:

- The basic meaning of red as something you cannot do and yellow as a warning sign
- No left turn, right turn and U-turn symbols
- Wrong way and do not enter signs
- Divided highway symbols
- Pedestrian crossing symbols
- Merge symbol
- Slippery when wet symbol
- School zone and crossing symbols
- Double broken lines
- Reversible lane controls (arrow and "x")
- Diagrammatic signs

Driving Alternatives--Many older drivers simply cannot drive safely. They need to be encouraged to restrict severely their motor vehicle operation. Content of the manual should include:

- The importance of voluntarily reducing or avoiding driving
- Alternatives including mass transit, taxis, community transportation services for the elderly
- Means by which older drivers can use political pressure to bring about driving alternatives
- Lists of local agencies available to help provide transportation to older people

Approach

Dissemination of information to older drivers should involve the following approaches.

Peer Mediation--Gerontologists have advised that information intended for older drivers should be communicated through older drivers. The most efficient way of doing this is by utilizing established organizations, such as retirement associations, old-age assistance groups, senior citizen organizations, retirement communities, and residence facilities provided for older people.

Problem-Oriented Approach--Information presented to older people should address the problems of age rather than age itself. The fact that many older drivers are as safe as drivers in their middle years should be granted.

Media--The system of delivering information to older drivers must take account of the visual problems that tend to accompany advancing years. Printed materials should use the largest, boldest, and clearest form of type available.

VIOLATORS

Prior research has shown that violators differ somewhat from non-violators in general background, education, and a variety of personality factors. However, the differences are small, do not involve driving information, and tend to reflect the influence of a small corps of truly chronic violators. Generally speaking, the weight of scientific evidence supports the conclusion that the principal difference between traffic violators and non-violators is "who got caught."

While violators are not distinguishable from other drivers on the basis of information needs, they can be distinguished in terms of accessibility. Conviction for a traffic violation provides a form of "leverage," that can be applied by courts and departments of motor vehicles to "encourage" participation in information programs that would be of equal benefit to non-violators.

Content

There seems to be no need to acquaint violators with the nature of traffic laws. Very few violators break traffic laws through ignorance of the laws themselves. However, there appears to be a sizeable number of drivers who break the law through ignorance of the reasons underlying the law. Providing information which explains the law may help by influencing the attitude of these drivers toward observance of the law. Obviously, it is not feasible to treat all traffic laws in a manual for traffic violators. Rather, content should focus upon those laws that are most commonly violated and for which there exists some explanatory information of which many drivers may be unaware. Laws meeting these criteria include the following:

- Exceeding the speed limit
- Driving too fast for conditions
- Following too closely
- Unsafe passing
- Failure to come to a complete stop at a stop sign
- Running a yellow light
- Knowing failure to yield the right-of-way

Another category of information that appears appropriate for inclusion in a violators manual is information relating to penalties for other than first time offenses, e.g., the State's "point system."

Research indicates that drivers who have two or more violations in any one-year period are very likely to have at least one violation in the following year. Is it not desirable to use the occasion of the first contact to provide information that might play a part in reducing the likelihood of other violations? And, is not simply having an inordinate number of violations sufficient to establish the relevance of information pertaining to traffic violations in general?

Approach

A convicted traffic violator is likely to react with a certain degree of hostility to being singled out as a traffic violator. Information should be introduced as being an attempt to help drivers to avoid future convictions. Threats, moralizing, or even dwelling upon the violation is likely to discourage reading of the publication.

ACCIDENT REPEATERS

Most accident involved drivers tend to perceive of themselves as victims rather than perpetrators of accidents. An information program that attempts to keep drivers from "causing" accidents is not, therefore, likely to find much acceptance among accident involved drivers. On the other hand, one that purports to help drivers avoid having accidents caused to them--that is, one that conveys "defensive driving" information--may not only prove acceptable but may even be appreciated.

Content

Critical defensive driving principles may be drawn from the information requirements identified previously for new drivers. Information of an essentially defensive nature includes the following:

- Scanning ahead, to the side, and behind
- Communicating the vehicle's presence by use of lights, horn, emergency signals, and position
- Maintaining a safety margin between the car and other vehicles
- Use of seat belts

Approach

While the content of a manual for accident repeaters may be concerned with ways of defending oneself against the unsafe acts of others, the idea of shared culpability should be introduced. Drivers should be diplomatically led to the realization that all parties to an accident generally share some responsibility for it.

DRINKING DRIVERS

Among traffic violators, drinking-driving offenders warrant special attention for two reasons. First, drinking and driving is the single most serious traffic offense. Somewhere between a third and a half of traffic fatalities involve the use of alcohol. Secondly, drinking and driving is distinguished from other traffic offenses by the fact that the behavior that leads to the offense does not involve how one drives, but rather when and how much one drinks.

Content

Convicted drinking drivers are generally rather familiar with the laws relating to drinking and driving, as well as the penalties that may be levied upon those who violate the law. An information program for convicted drinking drivers should have two aims: (1) to motivate drivers to control alcohol consumption, and (2) to provide practical means for exercising such control short of giving up either drinking or driving. The following topics are appropriate to an information program intended for convicted drinking drivers:

- Magnitude of the Drinking-Driving Problem
- Effects of Alcohol
- Alcohol Content of Drinks
- Separating Drinking and Driving
- Controlling Drinking
- Laws and Penalties
- Need for a Plan

Approach

The approach taken in communicating information to convicted drinking drivers should be straightforward and factual. While there should be no hesitation in identifying the hazards of drinking and driving, or the penalties for a second offense, there should not be an appearance of lecturing or moralizing.

DEVELOPMENT OF MANUALS

A set of manuals was prepared to fulfill the information requirements specified for each target group. This section discusses the content, organization, style, and pilot testing of the manuals.

CONTENT

In preparing content to support the informational requirements of each target group, only the specific information that was needed, could be understood, and could be retained was included in the manual. Many types of information frequently found in the driver manuals was excluded. Such exclusions included the following:

- Descriptions having no implications for safe driving practice, e.g., pictures of highway signs.
- Definitions that do not aid in the understanding of safe driving.
- Concepts that are difficult to apply to actual practice, e.g., centrifugal force.
- Information that is available to drivers when they need it, e.g., speed limits in areas where they are customarily posted.
- Technical detail that drivers are not likely to remember, e.g., specific stopping distances.

State laws were not communicated in their original form. Rather, they were presented in the form of more general safe driving practices. This rendered them more readily comprehended and made them applicable wherever an individual might drive.

ORGANIZATION

To make the manual more readily usable to drivers, the following approaches were taken to organization of each manual's content:

- Sections--Content was organized in brief, self-contained sections to accommodate the tendency of individuals to enter the manual in a random fashion.

- Information Access--To help readers find the information they wanted, each manual had a detailed table of contents. The larger manuals also provided an alphabetized index. Information that was frequently used was placed in front of the manual.

- Principles--Where possible, specific driving procedures were combined to form more general principles. The use of principles to help to economize on space as well as facilitate acquisition and retention of information.

STYLE

All manuals were written at a fifth to sixth grade reading level. This level appears to be an optimum in that it communicates with drivers having low levels of reading ability without encumbering drivers who read well.

Illustrations were used wherever necessary for accurate communication of information. The following guidelines were used in preparation of illustrations:

- Perspective--To the maximum extent possible, illustrations were shown from the driver's point of view in order to facilitate their comprehension by drivers of limited mental ability.

- Detail--Illustration provided only that detail needed to communicate required content.

- Color--Use of color was limited to that needed to communicate effectively.

PILOT TESTING

All manuals were pilot tested by administering them to groups of drivers who were representative of the target groups for which they were written. To allow assessment of information gain, tests were administered both prior to and following reading of the manual. In addition, an analysis was made of specific test items in order to identify the following:

- Information possessed by drivers prior to reading the manual, and which, therefore, might be given less emphasis in the manual.

- Information not possessed by drivers after reading the manual, and which needed to be given emphasis through revisions in the content, organization, or style of the manual.

Manuals were revised on the basis of pilot test results. They were then given one final review by consultants and representatives of each pilot group in order to verify their adequacy.

DEVELOPMENT OF TESTS

A set of multiple-choice test items was prepared to accompany each of the manuals. The number of items varied with the size of the manual, ranging from 10 items for the drinking driver's manual to 140 items in the case of the manuals for new drivers and renewal applicants.

TEST CONTENT

All of the test items were drawn directly from the corresponding manual. No test item called for information that was not provided in the manual. In selecting information for test items, the following guidelines were observed:

- Comprehensiveness--To the maximum extent possible, items were drawn from all parts of each manual. Limitations were, however, imposed by the inability to measure certain knowledges through multiple-choice tests.
- Level of Difficulty--Information was included regardless of its level of difficulty. No attempt was made to exclude very difficult or very easy items.
- Internal Consistency--The correlation of items with other items was not a basis for inclusion in the test. No items were eliminated on the basis of part-whole correlations.

ALTERNATIVE RESPONSES

Correct answers and distractors were selected so as to differentiate clearly between those who do and those who do not possess a particular item of information. The following procedures were observed:

- All alternative responses dealt with the same item of information.
- Only one alternative response was correct; examinees were not asked to find the "best" answer.
- Mutually exclusive alternatives were excluded.
- The catch-all alternatives "all of the above" and "none of the above" were avoided.

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WORDING

Questions were phrased so as to communicate clearly what information was sought without providing cues to the answers. To achieve this objective, the following procedures were followed:

- Questions and alternative responses were stated briefly and clearly.
- Use of the negative form was avoided.
- Alternatives were similar in terms of length and terminology.
- The use of safety buzz words was avoided.
- To the extent possible, questions were expressed in terms of driving application.
- Key words were emphasized.
- Ambiguious terms were avoided

Illustrations were provided where (and only where) necessary to communicate questions effectively.

TEST STRUCTURE

The following procedures guided the assembly of alternatives and items to form a test:

- Any numerical or logical progression was observed in ordering alternative responses.
- The position of the correct answer was decided by chance.
- Each item was made independent of the other.
- A sample item was provided for each test.

PILOT TESTING

The results obtained through administration of the test during the pilot test of manuals were examined to identify deficiencies in test items. Attention focused upon the following:

- Easy Items--Items correctly answered by 90% or more of the examinees were inspected to see if wording of the question provided clues as to the correct answer.

- Difficult Questions--Questions answered correctly by less than half of the examinees were inspected to determine if the wording of the question was confusing or misleading.

- Response Distribution--The response distributions were studied to see if certain alternatives were so implausible as to attract no responses.

Where deficiencies in test items were observed, they were corrected. Otherwise, they were left in their original form. No attempt was made to change test items simply on the basis of item statistics.

ALTERNATIVE INFORMATION PRESENTATION AND TESTING SYSTEMS

A printed manual and written test are probably the most cost-effoctive media for presenting information to, and assessing possession of information by, the general driving public. However, a significant number of drivers lack the ability to interact effectively with printed manuals and written tests, even when they are written at the sixth grade level. These people can be divided into the following categories:

> Illiterates--The number of license applicants who are unable to read or write is not truly known, since applicants are not administered literacy tests. However, between 10% and 20% of drivers in various States request and are administered an oral examination. The number in any State varied depending upon the characteristics of the drivers within the State and the policy governing administration of oral exams. From an administrative point of view, the number of applicants requesting oral exams is probably more significant than the number of true illiterates.
>
> Marginal Readers--The reading level of a large number of drivers falls between complete illiteracy and the fifth to sixth grade reading level that characterizes even the most simply written manuals and tests. In many ways, drivers with marginal reading ability pay a greater penalty in test taking than do total illiterates, since many are unwilling to admit their deficiency and therefore attempt to take the test without assistance.
>
> Foreign Speaking Literates--In many States, a large and increasing proportion of the applicant population consists of individuals who are literate only in a foreign language. Where the number representing a particular nationality is large, foreign language editions of manuals and tests can be cost-effectively produced. However, the less densely populated foreign language groups must be accommodated by other means.

As a step in overcoming the problems faced by illiterates, marginal readers, and foreign speaking drivers, an audiovisual presentation and audiovisual test were developed. The development involved an experimental study of information presentation mode, analysis of presentation and testing media, development of an audiovisual presentation, and design of an audiovisual test.

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EXPERIMENTAL STUDY OF INFORMATION MODES

To assess the effectiveness of various modes of presenting information, a small experiment was conducted. A set of test questions was presented to a group of drivers by means of the following informational modes:

Written--Conventional three-alternative multiple-choice questions.

Graphic--Conventional three-alternative multiple-choice questions accompanied by a diagram or picture.

Static Audiovisual--An audiovisual format using slides and a taped oral presentation.

Dynamic Audiovisual--An audiovisual format using a sound motion picture.

Examinees took the test items in all four modes. Since the level of knowledge was necessarily the same across modes, differences in results could be attributed to the differential effectiveness of the four modes in communicating the questions.

The test was administered to the following three groups:

High Verbal Skill--100 college students.

Medium Verbal Skill--100 students in an adult education program.

Low Verbal Skill--100 prison inmates having diagnosed reading deficiencies.

All three groups achieved the highest scores when test questions were presented in a dynamic mode. Results for the other three modes differed from one group to the next. The differences among the four modes failed to achieve statistical significance in an analysis of variance. However, since the chance probability of the dynamic mode surpassing the others in all three groups is only .016, the results appear to indicate the superiority of the dynamic mode.

SELECTION OF A PRESENTATION/TESTING MEDIUM

Having determined that a dynamic mode provided the most promising approach to information presentation and testing, a study was made of

the relative cost-effectiveness of various media in meeting the needs of a dynamic approach. The study addressed the following media:

- Filmstrip/Tape--A 35mm filmstrip programmed by a magnetic tape which also provides audio presentation.
- Slide/Tape--35mm slides programmed by a magnetic tape which also provides an audio presentation.
- Continuous Film--Standard 16mm and 8mm color film with sound track.
- Interrupted Film--16mm and 8mm film that can be stopped for static images and started again for dynamic sequences.
- Videotape--A color videotaped presentation played back through a videotape recorder (VTR) connected to a television receiver.

Filmstrips and slides are not generally considered "dynamic" presentations, since they involve still images. However, the images may be projected in a series to simulate motion--just like a motion picture film but at slower speeds.

The various media were evaluated against the following criteria:

Presentation

- Image--The resolution of the image as it influences ability to communicate essential characteristics of the driving situation.
- Motion--The ability of the image to convey situational dynamics.
- Reliability and Durability--The general life span of the equipment and freedom from breakdown, evaluated separately for:

  Hardware--Projectors, VTRs, audio equipment.

  Software--Film, filmstrips, slides, videotape.

- Ease of Operation--The speed and simplicity with which equipment can be set up for presentation of testing purposes.

- Maintenance--The amount of maintenance required in preventing and repairing malfunctions, as well as the speed and simplicity with which maintenance can be performed.

- Ease of Updating--The speed and simplicity with which the visual and/or audio components of the presentation can be changed in response to new procedures, laws, or other information.

- Cost--The procurement and operating cost, evaluated separately for:

  Hardware--Unit cost of hardware equipment as identified above.

  Software--Unit cost of audio and visual presentations.

On the basis of the comparison, filmstrips and slides were eliminated due to the failure of their cost advantages to offset their inability to handle motion adequately. Videotape was also eliminated due to the high cost of hardware, low durability of software, and the complexities of operation and maintenance.

Of the remaining media, an interrupted 8mm presentation appeared to have the greatest long range potential. However, since the required equipment is not in general use, an interrupted presentation would have a limited market at the present time. For this reason, it seems best to proceed with development of the standard 16mm motion picture within the present project. Preparing the presentation in a 16mm format would allow prints to be prepared in either 16mm or 8mm.

PREPARATION OF AN AUDIOVISUAL PRESENTATION

A motion picture film presentation was prepared to permit an evaluation of the effectiveness of the film medium in leading to acquisition of information by license applicants having reading disabilities that prevent them from comprehending written material prepared at the fifth to sixth grade reading level. The following criteria were imposed upon the development of the film presentation.

- Comprehensiveness--The film presentation had to present all of the critical information contained in the manual for new drivers. The volume of this information made preparation of an appropriate presentation a formidable task. Yet, there was no justification for depriving drivers of critical information, or relieving them of the responsibility for demonstrating its mastery on a written test, simply because they cannot read.

- Opportunity for Review--The information presentation had to provide an opportunity for review just like a written manual does.

- Non-Textual Information--While textual information such as titles and outlines could be included in the presentation, to allow its use by readers as well as non-readers, the success of the presentation in leading to knowledge acquisition could not be dependent upon textual material.

- Limited Duration--The total audiovisual presentation had to be divided into several presentations of shorter duration to provide greater flexibility in scheduling. A duration of approximately ten minutes was considered optimum.

A set of eight film presentations was prepared in accordance with the above specifications. The presentations covered the eight major sections of the manual. The duration of each presentation was as follows:

- Rules of the Road..... 7 minutes & 2 seconds
- Observing..... 8 minutes & 47 seconds
- Communication..... 6 minutes & 2 seconds
- Speed Control.....10 minutes & 1 second
- Inter-vehicle Separation and Gap Acceptance..... 8 minutes & 22 seconds
- Emergency Procedures..... 8 minutes & 20 seconds
- Driver Factors..... 8 minutes & 20 seconds
- Vehicle Factors..... 2 minutes & 55 seconds

59 minutes & 49 seconds

All filming was done in 16mm. Most of the footage involving driving scenes was taken from the driver's point of view. While most of the footage was shot in the Washington, D.C. area, stimuli of an identifiably local nature--local scenery, signs, police cars, etc.,--were avoided

where possible in order to maximize the film's acceptability across the country. Animation was used where necessary to communicate complex information, such as the relation of amount and rate of alcohol consumption to the level of intoxication. It was not used simply to heighten interest or to entertain.

DESIGN OF AN AUDIOVISUAL TEST

Project funds did not permit the preparation of a dynamic audiovisual test to accompany the informational presentation. However, the audiovisual test that was developed for the experimental study of informational modes provided some insight into the requirements of an audiovisual test. These requirements may be summarized as follows:

- Automation--An audiovisual test must be fully automatic if it is to overcome the administrative burden imposed by oral testing.

- Simple Instructions--Because an examiner will not be present, instructions must provide a simple step-by-step procedure. Each step should be made as small as possible to minimize short term memory requirements.

- Increasing Difficulty--The initial questions should be relatively easy so that administrative procedures are completely mastered before difficult questions are asked.

- Problem Identification--There must be a mechanism for identifying applicants who do not understand administrative instructions. One approach is to precede the test with sample questions that everyone should know the answers to.

- Presentation of Alternatives--Since alternatives in a dynamic presentation cannot be presented simultaneously, they must be presented sequentially. The alternatives may be presented once for the examinee to select an answer and a second time to permit the examinee to indicate a response.

- Response Recording--Responses may be recorded either in a paper-pencil format or by use of mechanical/electrical response recorders.

- Test Pacing--Allowing additional time to select a response does not improve performance when alternatives are presented sequentially. If questions are clear and unambiguous, and immediate response can be called for.

EVALUATION

An evaluation of the manuals, tests, and audiovisual information presentation was undertaken in the State of Virginia. Evaluation of the manuals and tests involved some 60,000 drivers representing all of the target groups. Within each target group, drivers were randomly divided into EXPERIMENTAL and CONTROL groups. Drivers in the EXPERIMENTAL groups were administered the project developed manuals and test while those in the CONTROL groups were subject only to procedures currently employed by the State. The effectiveness of the manuals and tests were evaluated against three objectives:

1. Information Acquisition--Effectivenss of the manuals and tests in leading to acquisition of required information.

2. Information Retention--Effectiveness of the manuals and tests in leading to retention of information originally acquired.

3. Information Application--Effectiveness of the manuals and tests in leading to changes in driving behavior as reflected in lower accident and violation records.

Evaluation of the audiovisual presentation involved assessment of information acquisition among limited numbers of drivers representing various categories of reading disabilities. The project did not call for an evaluation of the audiovisual presentation in terms of accident and violation records.

EXPERIMENTAL PROCEDURES

The procedures used to disseminate information and administer tests to the EXPERIMENTAL and CONTROL groups differed appreciably from one target group to another. Each group must therefore be described separately.

New Drivers

Evaluation of the manual for new drivers involved 8,000 driver education students in Northern Virginia high schools. The driver education classes in each school were randomly divided into EXPERIMENTAL and CONTROL groups. The EXPERIMENTALS received the new manual, while

the CONTROLS were administered the regular written test. License application cards were coded to permit the applicant's group assignment to be identified by DMV clerks and entered into the driver's record.

Renewals

Northern Virginia drivers whose licenses were about to expire were randomly assigned to EXPERIMENTAL and CONTROL groups, and their group assignment was entered into their driver record. The EXPERIMENTALS were sent the manual prepared for renewal applicants and told they would have to pass a written test to renew their license. Their renewal application was coded to permit their identification by DMV personnel. The group assignment of those not bringing their cards was determined by examination of their driver records which could be accessed by station personnel through a remote terminal. Approximately one-quarter of the EXPERIMENTALS refused to take the test. Their licenses were still renewed, and they remained in the sample.

The CONTROLS, following the standard procedure, were not given a manual or required to take a test.

The procedure was carried on over a six-month period to obtain the total sample size of 26,000 drivers.

Older Drivers

Drivers over the age of sixty were handled in the same manner as renewal applicants except that the EXPERIMENTALS were sent the manual for older drivers and a renewal application card indicating they should be administered the test prepared to accompany the manual. The sample of older drivers totaled 8,000.

Violators

Under Virginia law, drivers who compile eight points or more under the State Driver Improvement Program are required to report for a group interview. The groups, once constituted, were randomly assigned to EXPERIMENTAL and CONTROL groups. A notation of group assignment was entered into each driver's record. The EXPERIMENTALS received a copy of the manual prepared for violators and were administered a test upon reporting for their interview. The CONTROLS were only required to participate in the interview. In all, 6,000 drivers throughout the State were involved in the experiment.

Accident Repeaters

A total of 6,000 drivers having had two or more accidents in the previous three-year period, including one within the previous six months, were selected from license records and assigned randomly to EXPERIMENTAL and CONTROL groups. A notation of group assignment was entered into each driver's record. Those in the EXPERIMENTAL group were sent a copy of the manual for accident repeaters along with a test which they were asked to complete and mail back. Since Virginia drivers cannot be required to take a test simply on the basis of their accident records, the program was entirely voluntary. All told, 41% of the EXPERIMENTAL sample returned tests.

No action whatever was taken with respect to CONTROLS.

Drinking Drivers

Following initiation of the experiment, a change in the Virginia law regarding drinking drivers resulted in a decline in the numbers of convicted drinking drivers who would be available for the experiment. Therefore, evaluation of the manual for drinking drivers was made a part of a study which was to take place in California following completion of the present project. In this study, 30,000 drivers will be divided into three groups. One group would receive informational materials, while a second group would merely receive a warning letter, and a third group would receive no communication at all. One-third of the 10,000 drivers scheduled to be sent informational materials would receive the manual prepared for drinking drivers. The group assignment, and nature of materials sent, would be indicated in the driver's record to permit a follow-up. One-half of the drivers receiving informational materials would be sent tests which they would have to complete and return to the DMV.

Audiovisual Presentation

The audiovisual presentation was evaluated through administration to a group of 75 high school students having diagnosed reading difficulties serious enough to render them incapable of comprehending materials written at the fifth or sixth grade reading level. Of these students, 40 were unlicensed and 35 held drivers licenses. In addition to those students with reading difficulties, 15 unlicensed students diagnosed as being "educably mentally retarded" were also administered the presentation.

All students were given a pretest and a posttest using two equivalent forms of the test developed for new drivers. The questions were given orally by a representative of the project staff. Those who were seeking to obtain a license were orally administered a third form by the license examiner following the administration of the posttest.

INFORMATION ACQUISITION

To obtain a measure of information acquisition, the tests were to samples of drivers drawn from the same general population as the EXPERIMENTALS. The results obtained from this "pretest" administration were then compared with those obtained by samples drawn randomly from the EXPERIMENTAL groups. This procedure was followed with all target groups except for the drinking drivers and those receiving the audiovisual presentation.

The drinking driver group had not been tested. To permit an immediate assessment of information acquisition, the manual was given as a class assignment to a group of adult education students. Test scores obtained following reading of the manual were compared with those obtained by a group of convicted DWIs who had not read the manual. In the case of the two groups receiving the audiovisual presentation, the "reading disabled" and "mentally retarded" groups, the pretest and acquisition test results were obtained from the same individuals using alternate test forms.

The results obtained through acquisition testing appear in the table on the next page. The "gain" score is the difference between acquisition scores and pretest scores expressed as a percent of pretest scores. All groups evidenced significant information gains through use of the informational materials. Gains from reading manuals ranged from 11% for the violator group to 33.1% for the new driver group. The small gain obtained by the violator group is believed to result from an uncooperative attitude on the part of the violators rather than a deficiency in the manual. It is believed that greater acquisition of information would have been evidenced had the manual and test been offered as a substitute for a compulsory interview, or had been introduced after the interviewer had been given an opportunity to

The audiovisual presentation produced significant information gains among all three groups receiving it. The Mentally Retarded group evidenced the greatest gain, a eflection of the low initial knowledge level. Ten of the 15 individuals in this group subsequently passed the examination administered by the State examiner and received their learner's permit.

ACQUISITION AND RETENTION TEST RESULTS FOR ALL TARGET GROUPS

GROUP	PRETEST		ACQUISITION				RETENTION			
	MEAN	N	MEAN	N	GAIN	SIGNIF-ICANCE	MEAN	N	RESIDUAL GAIN	SIGNIF-ICANCE
New Driver	61.4	100	81.7	100	33.1%	P < .01	72.8	99	18.6%	P < .01
Renewal	62.9	100	79.8	100	26.7%	P < .01	74.8	63	18.9%	P < .01
Older Driver	69.0	100	83.0	100	20.3%	P < .01	88.8	74	28.7	P < .01
Violator	61.8	100	68.6	200	11.0%	P < .05				
Accident Repeater	64.1	100	83.0	100	29.5	P < .01				
Drinking Driver	64.9	100	86.2	100	32.0%	P < .01				
Reading Disabled Unlicensed	58.3	40	67.3	40	15.4%	P < .01				
Licensed	67.0	35	72.7	35	8.5%	P < .05				
Mentally Retarded	49.7	15	63.3	15	27.4%	P < .05				

ASSESSMENT OF INFORMATION RETENTION

The reason given for renewal testing is the existence of knowledge deficiencies among renewal applicants as a result of the following:

1. Inadequacies in the knowledge tests and manuals under which they were originally licensed.

2. Changes in traffic laws and driving conditions that have arisen since they were orignally tested.

3. The possibility that substantial forgetting of important safe driving information has occurred since they were last tested.

Inadequacies in earlier manuals and tests can be identified as can changes in traffic laws and driving conditions. However, just how much forgetting occurs, and just what is forgotten are more difficult to determine.

To measure the retention of information among licensed drivers, a retention test was administered to samples of new drivers, renewal applicants, and older drivers selected randomly from the EXPERIMENTAL group. The tests were administered approximately five months following their acquisition test. New drivers were tested in their respective high schools. Renewals and older drivers were sent letters requesting their participation and copies of the test to mail back. Each of the new drivers and renewals was sent a test form that was different from the one originally taken. Older drivers received the same form, since only one was developed. Close to a 100% participation was obtained from the new drivers. However, slightly under 50% of the renewals and older drivers returned tests. As might be expected, those who cooperated had slightly higher scores on their original acquisition tests than did the EXPERIMENTAL sample as a whole. Scores on retention tests were corrected to eliminate the effect of the higher acquisition scores.

The retention test results appear at the right hand side of the previous table. The "residual gain" is the difference between the retention score and the pretest score, expressed as a percentage of the pretest score. The new drivers retained only approximately one-half of their original acquisition gain, while renewals retained approximately two-thirds of their initial gain. Interestingly enough, the older drivers evidenced an improvement from their original acquisition test. This probably means that substantial numbers of older

drivers reread their manuals prior to taking the retention test, even though they were asked not to do so. The fact that the manuals were still in their possession after a five-month interval is noteworthy.

ASSESSMENT OF INFORMATION APPLICATION

The ultimate test of an information presentation and testing program is not whether the information is learned or remembered, but whether it is applied. If the objective of an information program is to foster highway safety, the effects of the program should eventually be revealed by a reduction in the number and severity of automobile accidents. After all, what does "safety" mean other than the absence of accidents?

Length of Follow-Up

The longer a driver's performance is observed, the more likely it is that unsafe behavior will show up in an accident. Therefore, in an effort intended to detect the difference between safe and unsafe driving behavior, the longer the follow-up period is, the better. However, the urgency of the research question imposes a time limitation. The researcher cannot afford to wait for a lifetime of driving to occur in order to see if his treatment is taking. The maximum amount of time that could be reasonably allotted to the follow-up period during the present study was two years. It was on the basis of a two year follow-up period that need for a sample of 60,000 was based.

It is, of course, possible that the information program will be so effective as to become evident in a shorter period of time. To allow for this possibility, follow-ups were also scheduled at periods of one year and one and a half years following completion of the information acquisition phase of the project. Even the shortest of these periods extends well beyond the termination of this project. Therefore, the results of the follow-up are not provided by this report. The follow-up study will be performed by the Virginia Division of Motor Vehicles and will be reported separately.

Follow-Up Procedures

At 12, 18 and 24 months following completion of test administration, the records of all drivers in the State of Virginia will be searched and those of drivers in the study will be read into separate files, classified by target group designation and study group assignment (i.e., EXPERIMENTAL versus CONTROL). The search will address all target

groups at the same time. Therefore, the actual follow-up intervals for some target groups will extend a few months beyond the stated intervals, depending upon the date upon which testing terminated for that target group. California will employ one follow-up conducted 14 months following completion of information dissemination.

The accidents and violations appearing in the records of drivers in each target group and each treatment group will be tabulated and the following totals obtained:

- Number of accidents reported
- Number of convictions for traffic violations
- Convictions for violations involving an accident
- Administrative actions

  Advisory Letters

  Group Interviews

  Personal Interviews

  Clinics

  Probation

  Suspensions

The accident totals will include both culpable and non-culpable accidents; the Virginia accident file makes no distinction. The goal of the safe driving information program is to reduce all accidents. The content of the various manuals deals as much with prevention of non-culpable accidents, that is, defending against accident situations created by the unsafe acts of others, as it does with prevention of culpable accidents.

CONCLUSIONS

Following is a list of conclusions reached as a result of the activities and findings described in the preceding pages.

1. A manual providing a comprehensive and exhaustive presentation of critical safe driving information can be prepared for new drivers within the resources available to most driver licensing agencies.

2. Experienced drivers currently present the same general pattern of information deficiencies as do new drivers. Except for basic rules of the road, which they already know, and information relating to the licensing process and skill development, which they don't need, experienced drivers can generally benefit from the same general types of information as are needed by new drivers.

3. Traffic violators, including drinking drivers, are no different from the general driving public with respect to their information deficiencies or needs. However, their record of violations provides both a legal and social justification for requiring the acquisition of safe driving information. To be effective, this information should be generally related to the subject of traffic violations. A manual for traffic violators is likely to experience a hostile reception unless it is introduced in conjunction with, or as an alternative to, a driver improvement program involving direct control.

4. Like traffic violators, drivers who have been in accidents present the same general pattern of information strengths and weaknesses as is presented by the general driving public. Unlike traffic violators, however, most cannot be required to participate in an information program. While some will do so on a voluntary basis, many--if not most--will not.

5. Older drivers are the only group presenting unique information requirements. Their information needs largely involve methods of identifying, ameliorating, or compensating for age-related driving disabilities.

6. Drivers in all groups are capable of realizing significant knowledge gains from manuals designed to meet their information needs. The gains range from approximately one-tenth to one-third of initial knowledge levels.

7. A significant information loss occurs following acquisition of large amounts of safe driving information, such as is provided new drivers and renewals. The magnitude of the loss ranges from one-third to one-half of the information originally acquired. The loss is specific to certain items of information, indicating the value of periodic reinforcement relative to individual items. In some cases, drivers may evidence an information gain during the months following initial acquisition, indicating continued recourse to the manual.

8. An audiovisual presentation is capable of leading to significant information gains among reading disabled and learning disabled license applicants. The gain is sufficient to allow a sizeable proportion of such drivers to qualify for a license.

9. No conclusions as to the effectiveness of the various manuals and tests in preventing accidents can be offered at the present time. Such conclusions will be presented in a separate report, following a comparison of driving records compiled by those receiving the manuals and an equivalent group of drivers who were given neither the manuals nor tests.

RECOMMENDATIONS

Recommendations for future activity may be divided into two categories, those relating to research and development activities and those related to operational licensing programs.

RESEARCH AND DEVELOPMENT

Based upon the experiences gained in the present study, the following recommendations for continued research and development are offered:

1. The content of a driver information system should be expanded beyond a program for drivers of four-wheeled passenger vehicles to include the following categories of vehicles:

   - Motorcycles
   - Recreational vehicles (e.g., campers, trailers, motor homes)
   - Commercial trucks and buses
   - School buses
   - Emergency vehicles

2. The mechanisms employed in a driver information system should be expanded to encompass all those involved in driver control including, in addition to licensing, those involved in enforcement, adjudication, and driver improvement. Particular attention should be directed towards means of obtaining a greater acceptance of an information program on the part of convicted traffic violators. The development of a broader driver information system should address the interface of control mechanisms with public information and education mechanisms, such as schools, community organizations, the private sector, and public media. However, the system itself should not duplicate the functions served by these mechanisms but should confine itself to the functions involving driver control.

3. Means of fulfilling specific needs identified during this project should be studied. These needs include the following:

   - A method of obtaining the participation of accident repeaters in an information program, either on a compulsory or voluntary basis.

- Making available a dynamic audiovisual information presentation and test, suitable for use by driver licensing agencies in extending to reading disabled drivers the same benefits that are afforded the driving public at large.

- Identification of specific information items that drivers tend to forget over time, and the development of a Renewal Manual and test containing this information.

OPERATIONAL PROGRAMS

Until the cost-effectiveness of a driver information system has been established through an examination of driver accident experience, recommendations for changes in operational licensing programs must be confined to those that can be put into effect without substantial cost or the need for enabling legislation. In consideration of this limitation, it is recommended that States consider the following actions:

1. Expanding the scope of State driver manuals to encompass the broad array of critical driver information contained in the New Driver Manual. By following guidance concerning exclusion of unessential information, avoidance of unnecessarily elaborate format, and better organization of content, most States could accommodate a broader information program without an appreciable increase in cost.

2. Accompanying expansion of the New Driver Manual with development of a manual patterned after the Renewal Manual and administering it to all licensed drivers on a one-time basis as part of the license renewal process.

3. Preparing an orally administered knowledge test based upon items that are dealt with in the audiovisual presentation. This action would allow schools and other agencies to use the audiovisual presentation in preparing reading disabled drivers for the knowledge test.

4. Consider the suitability of certain of the individual manuals and associated tests to ongoing programs of licensing and driver improvement.